



Cambridge International AS & A Level

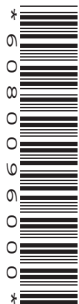
CANDIDATE
NAME

CENTRE
NUMBER

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PHYSICS

9702/34

Paper 3 Advanced Practical Skills 2

May/June 2020

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You will be allowed to work with the apparatus for a maximum of 1 hour for each question.
- You should record all your observations in the spaces provided in the question paper as soon as these observations are made.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [].

For Examiner's Use	
1	
2	
Total	

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You may not need to use all of the materials provided.

1 In this experiment, you will investigate the balance of a pivoted rule.

(a) The apparatus has been partially assembled for you.

- Add the mass M to the apparatus as shown in Fig. 1.1. The mass M should be suspended approximately 15 cm from the nail.

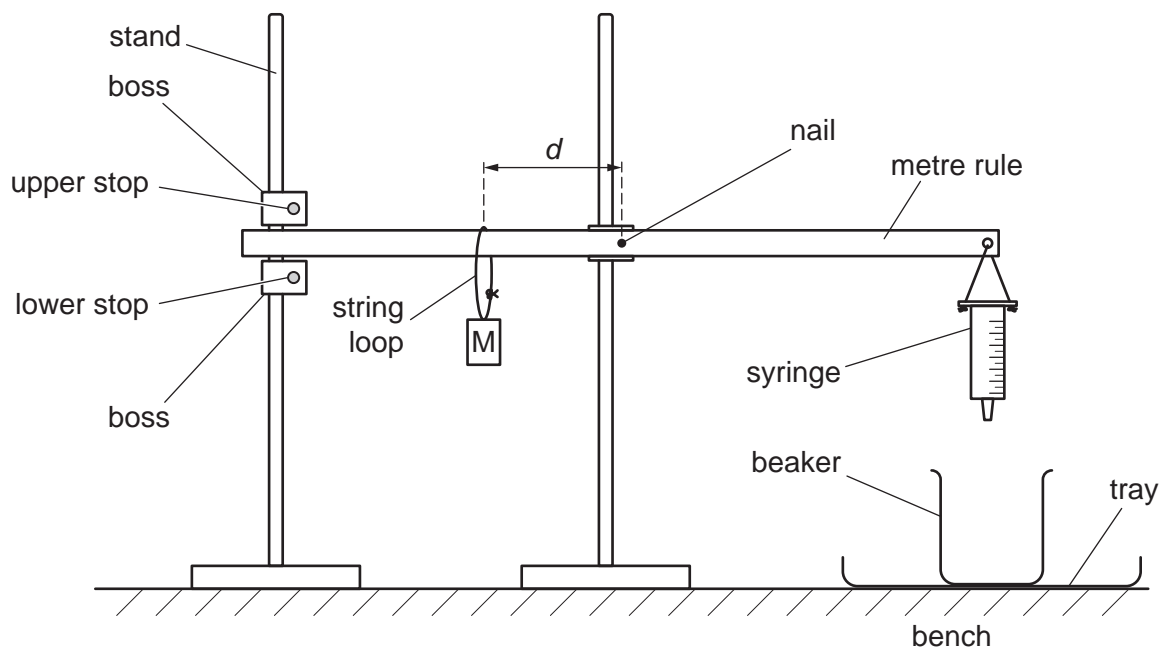


Fig. 1.1

- The distance between the nail and the string loop attached to M is d , as shown in Fig. 1.1.

Measure and record d .

$$d = \dots\dots\dots \text{ cm [1]}$$

- (b)**
- Pour water into the syringe until it is full. The rule will tilt until it touches the upper stop. The water will flow out of the syringe.
 - The time between the water level passing the 50 cm^3 mark on the syringe and the rule losing contact with the upper stop is t .

Measure and record t .

$$t = \dots\dots\dots \text{ s [2]}$$

4

(c) Change d by moving M. All values of d should be less than 25 cm.

Measure d and t . Repeat until you have six sets of values of d and t .

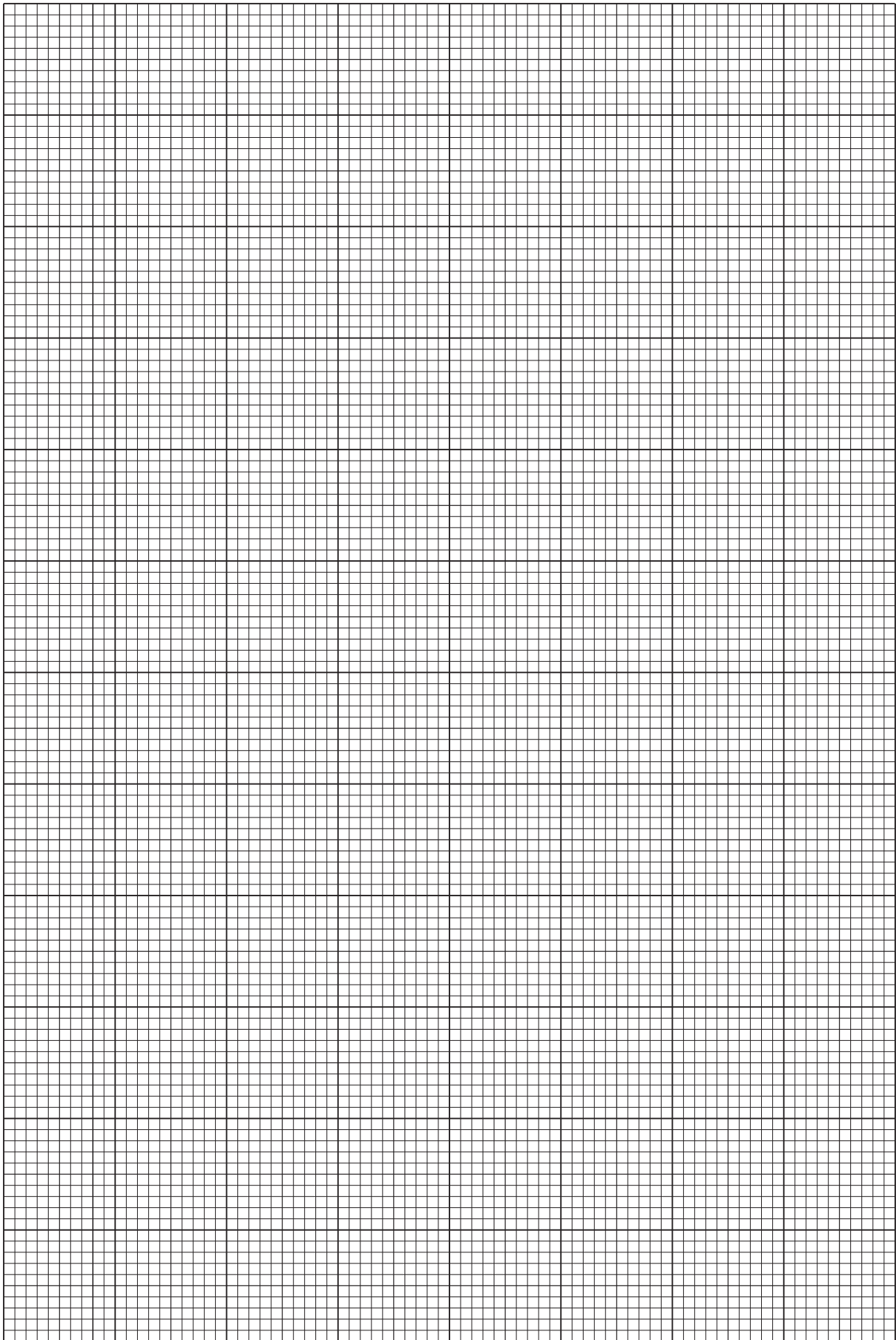
Record your results in a table. Include values of $\frac{1}{d}$ and t^2 in your table.

- (d) (i) Plot a graph of t^2 on the y -axis against $\frac{1}{d}$ on the x -axis. [9]
- (ii) Draw the straight line of best fit. [3]
- (iii) Determine the gradient and y -intercept of this line. [1]

gradient =

y -intercept =

[2]



6

(e) It is suggested that the quantities t and d are related by the equation

$$t^2 = \frac{a}{d} + b$$

where a and b are constants.

Use your answers in (d)(iii) to determine the values of a and b .
Give appropriate units.

$a =$

$b =$

[2]

[Total: 20]

You may not need to use all of the materials provided.

2 In this experiment, you will investigate the amplitude of oscillations of a mass suspended from a spring.

(a) (i) • Assemble the apparatus as shown in Fig. 2.1.

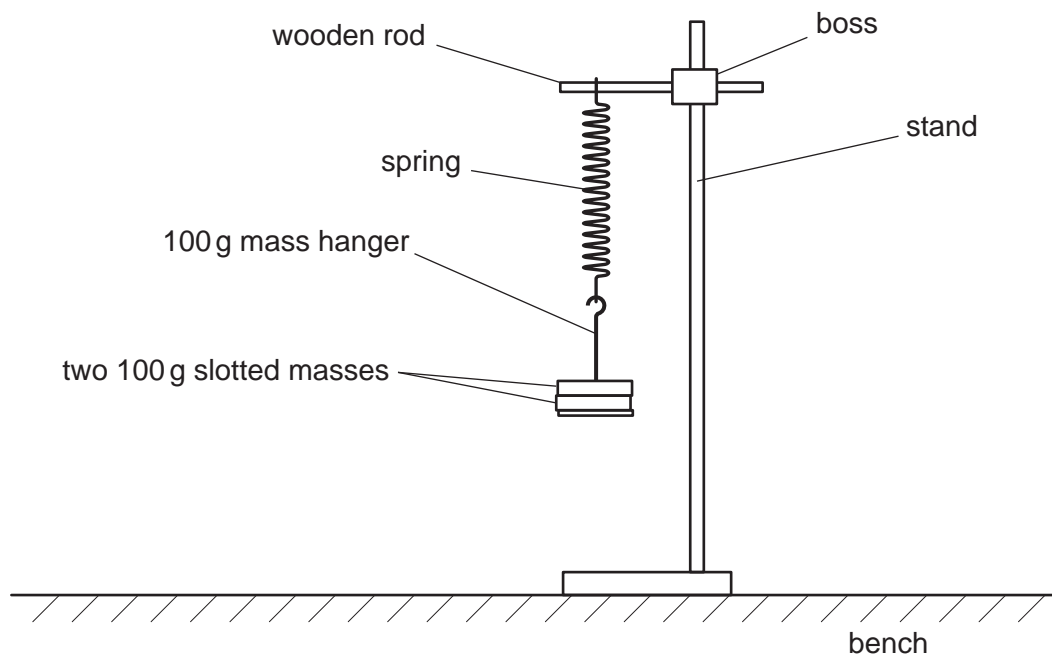


Fig. 2.1

- Pull the mass hanger and slotted masses down through a short distance. Release them so that they oscillate vertically.
- Measure and record the period T of the oscillations.

$T = \dots\dots\dots$ s [1]

(ii) Calculate the spring constant k using

$$k = \frac{4\pi^2 M}{T^2}$$

where $M = 0.300$ kg.

$k = \dots\dots\dots$ Nm^{-1} [1]

- (b) • Slide the two 100g slotted masses to the top of the mass hanger as shown in Fig. 2.2.

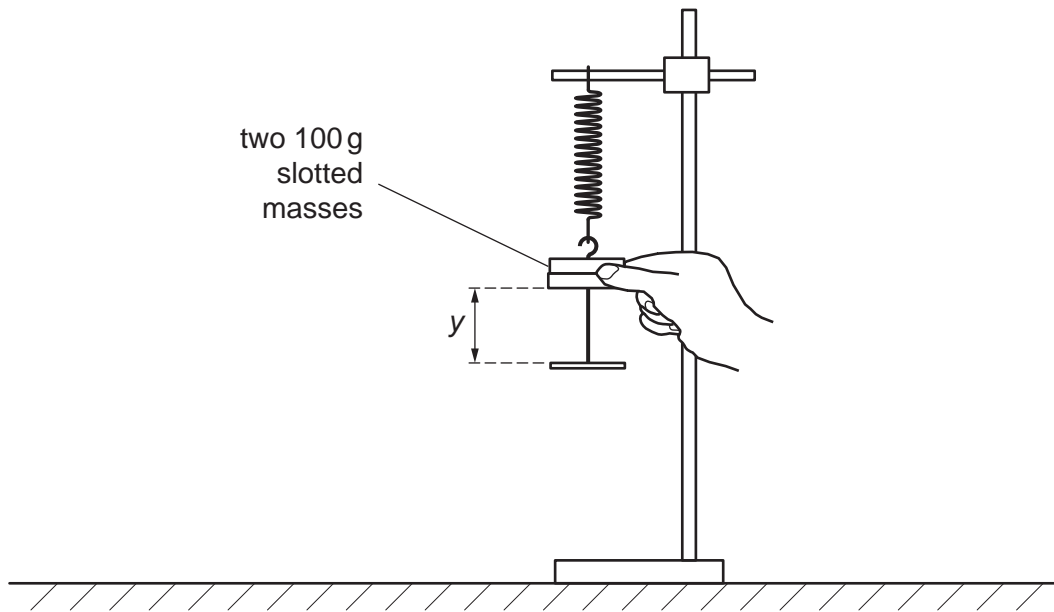


Fig. 2.2

- The height of the slotted masses above the base of the mass hanger is y , as shown in Fig. 2.2.

Measure and record y .

$y = \dots\dots\dots$ m [1]

- (c) • Drop the two 100g slotted masses. The masses and the mass hanger will oscillate vertically, as shown in Fig. 2.3.

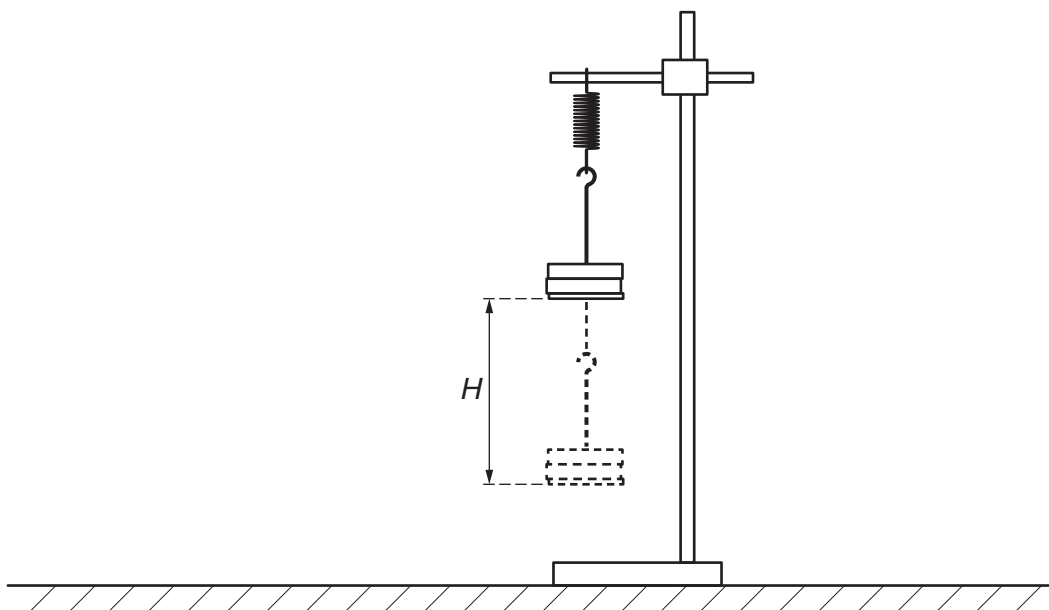


Fig. 2.3

9

- The distance between the lowest and highest positions of the oscillating mass hanger is H , as shown in Fig. 2.3.

Measure and record H .

$$H = \dots\dots\dots \text{ m [2]}$$

- (d)** Estimate the percentage uncertainty in your value of H . Show your working.

$$\text{percentage uncertainty} = \dots\dots\dots [1]$$

- (e)** Repeat **(b)** and **(c)** but this time sliding the two slotted masses approximately half-way up the mass hanger.

$$y = \dots\dots\dots \text{ m}$$

$$H = \dots\dots\dots \text{ m [2]}$$

10

- (f) It is suggested that the relationship between H and y is

$$H = c\sqrt{y}$$

where c is a constant.

- (i) Using your data, calculate two values of c .

first value of $c = \dots\dots\dots$

second value of $c = \dots\dots\dots$

[1]

- (ii) Justify the number of significant figures you have given for your values of c .

.....

.....

..... [1]

- (iii) Explain whether your results in (f)(i) support the suggested relationship.

.....

.....

..... [1]

(g) Theory suggests that an approximate value for the acceleration of free fall g is given by

$$g = \frac{c^2 k}{8m}$$

where $m = 0.200$ kg.

Use your value of k from **(a)(ii)** and your first value of c to calculate g . Include an appropriate unit.

$g = \dots\dots\dots$ [1]

(h) (i) Describe four sources of uncertainty or limitations of the procedure for this experiment.

1.
.....
 2.
.....
 3.
.....
 4.
.....
- [4]

(ii) Describe four improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

1.
.....
 2.
.....
 3.
.....
 4.
.....
- [4]

[Total: 20]

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